This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

**Usage guidelines**

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

**About Google Book Search**

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

QE
147
.A2

B 1,066,531

NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

---

# BIENNIAL REPORT

OF THE

# STATE GEOLOGIST

## 1899–1900

RALEIGH:
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS.
1900.

NORTH CAROLINA GEOLOGICAL SURVEY.

J. A. HOLMES, STATE GEOLOGIST.

# BIENNIAL REPORT

OF THE

# STATE GEOLOGIST

## 1899-1900

RALEIGH:
E. M. UZZELL & CO., STATE PRINTERS AND BINDERS.
1900.

# GEOLOGICAL BOARD.

| | |
|---|---|
| GOVERNOR D. L. RUSSELL, *ex officio Chairman*, | Raleigh. |
| J. TURNER MOREHEAD, | Leaksville. |
| CHARLES MCNAMEE, | Asheville. |

| | |
|---|---|
| J. A. HOLMES, *State Geologist*, | Chapel Hill. |

# TABLE OF CONTENTS.


| | PAGE. |
|---|---|
| LETTER OF TRANSMITTAL | 5 |
| REPORT OF THE STATE GEOLOGIST | 7 |
| Mining, Water-power and Timber Developments | 7 |
| Mineral Investigations | 8 |
| Forest Investigations | 10 |
| Water-power Investigations | 11 |
| Mineral and Artesian Waters | 14 |
| Good-roads Movement | 14 |
| Co-operation of Government Bureaus | 15 |
| Meridian Surveys and Monuments | 15 |
| Soil Investigations | 16 |
| Fish and Oyster Investigations | 16 |
| Office Work | 18 |
| Expenditures | 19 |

# LETTER OF TRANSMITTAL.

NORTH CAROLINA GEOLOGICAL SURVEY,

RALEIGH, N. C., December 15, 1900.

*To His Excellency,* GOVERNOR D. L. RUSSELL,
Raleigh, N. C.

SIR:—I have the honor to transmit herewith for your consideration and approval the administrative biennial report of the State Geologist for the two years ending November 30, 1900.

A summary of the expenditures of the Survey will be found at the end of this report; and the receipted itemized vouchers covering all expenditures have been approved by the Geological Board and deposited with the State Auditor.

The scientific and economic results of the Survey are being described in the special reports now being prepared and published.

Yours respectfully,

J. A. HOLMES,
*State Geologist.*

# BIENNIAL REPORT OF THE STATE GEOLOGIST ON THE OPERATIONS OF THE NORTH CAROLINA GEOLOGICAL SURVEY DURING THE TWO YEARS ENDING NOVEMBER 30, 1900.

By J. A. Holmes, State Geologist.

There has been considerable activity in industrial matters in North Carolina during the past two years; and this has manifested itself along their separate lines touched by the investigations of the Geological Survey, especially

## MINING, WATER-POWER AND TIMBER DEVELOPMENT.

In mining this activity has been specially noticeable in connection with the deposits of iron, copper, mica, corundum and talc, but it has also extended to other ores and miscellaneous minerals. Activity in mining matters has been greater during the present year than at any time during the present decade.

In mining, the demand for iron, the resulting increase in its price and the starting up of the furnace at Greensboro has made it possible to operate some of the old mines that have been idle for years, and has also led to opening up of new deposits of iron ore concerning which little or nothing was known heretofore. Many inquiries have been received for information concerning these iron deposits, and a considerable amount of outside capital has been invested in the State in their development. Copper deposits have also been in demand during the year and some good copper mining deposits have been opened and are being worked in Person and Granville, Rowan and Ashe counties. In mica mining the work has been confined largely to Mitchell, Yancey and Haywood, Jackson and Macon counties, but some work has also been done in Cleveland and Stokes. Talc mining has been in progress in Cherokee, Swain and Moore counties. Corundum has been mined mainly in Jackson, Macon and Clay counties.

In water-power development there has been more than usual activity on all of our larger streams, as on the Roanoke near Weldon; on the Neuse near Raleigh; on the Cape Fear at and above Smiley's Falls; and on its two tributary streams, the Deep and Haw; on the Yadkin in the vicinity of the Narrows, and several other points on the South Yadkin near its mouth; at several points on the Catawba and on Ivy river west of the Blue Ridge. In most of these places on the Neuse, the Yadkin and the Catawba the work has not yet gone further than surveys and plans; at others the work of developing is already in progress.

In timber developments there has also been unusual activity; and it is estimated that more than $2,000,000 has been invested in buying timber and timber lands in the eastern counties during the year. While the larger part of this activity has been devoted to the pine forests of this eastern belt, there has also been a considerable amount of money invested in the cutting of swamp timber along our eastern streams and the hardwood timbers in the middle and western counties.

One feature in connection with our timber interests deserves special mention, namely, the steady increase in the amount of timber used in the home manufacture of furniture and other articles.

The investigations of the Geological Survey have followed the same general lines as during the preceding year. The main features connected with this work are as follows:

## MINERAL INVESTIGATIONS.

1. In the examination of miscellaneous mineral deposits, mainly by Dr. J. H. Pratt, considerable time has been spent upon abrasive minerals, corundum, emery and garnet, and nearly all the known localities have been examined. While many of these have proved of little or no importance, some give promise of considerable economic value. Up to the present time corundum (not including emery) has only been profitable for abrasive purposes where associated with peridotite rock; but now corundum is known to occur in considerable quantity in certain of the schists of Jackson and Clay counties. As yet, the percentage of corundum in the ore has not been practically determined. Experiments made upon the clean product of schists

from the Caney Fork, Jackson county, show this corundum to be of very good quality.

Regarding the corundum deposits of Canada it is yet too early to know to what extent they will affect the output of this State, but it is doubtful whether they will do so at all. The Canadian ores contain 14.7 per cent. of corundum, while there are a number of ores in North Carolina that will carry twenty to thirty per cent. of corundum. While at the Corundum Hill mine, Macon county, this past summer, the ore was tested and found to contain forty-five per cent. of corundum.

The data obtained in the examination of these corundum mines and localities are being used in the preparation of a bulletin on the corundum and the corundum-bearing rocks that is soon to be published.

The chromite and talc deposits have been examined and a short paper has been published on the former. The manuscript for an economic paper on the talc deposits is nearly completed and will appear about the last of January. The talc deposits of the United States that have been supplying the market are becoming exhausted and a new source of supply is needed, or a substitute for the mineral. It is expected that the extensive beds of agalmatolite of Chatham and Moore counties will be largely used in the place of talc, as it has many of the physical properties of talc, and especially of those that make this mineral of value for its present uses. Already these deposits of agalmatolite are attracting the attention of capitalists, and there is very good reason to believe that they will be extensively mined. They have been examined and will be described in the paper on talc.

A number of gem mines and localities have been examined, of which the most interesting is the ruby mine in Cowee Valley, Macon county. No work was done at this mine during the past year. But preparations are being made to begin operations again in the spring. None of the products of this mine have as yet been put on the market, although a number of very fine gems have been found. The Rhodolite mine on Mason branch, Macon county, has been worked most of the year with very good success. The product of this mine is also being held back, so that at the present time there are very few rhodolites on the market. Both of these mines are owned by the American Mining and Prospecting Company of New York.

The Littlefield beryl mine has again been opened and preparations are on foot to thoroughly develop this mine in the spring.

Another locality has been discovered for the gem hiddenite which is almost adjoining the present well-known mine from which this beautiful gem has been obtained. The property is supposed to have been secured by the company who owned the original mine.

If possible, the bulletin on the gems of North Carolina will be brought out during the coming year. There is considerable interest becoming manifest among gem dealers for the development of the gem localities of the United States, and North Carolina, which is now known as the gem State on account of the number and variety of the gems that it has produced, will be one of the most attractive places for the prospector.

Collections of typical North Carolina minerals have been made of from twenty to thirty specimens each, and these have been sent to about fifteen of the colleges and schools of the State. This division also co-operated with the State Museum in obtaining mineral specimens for that department.

A report on the mining industry of the State during 1899 was prepared by Dr. Pratt for the Commissioner of Labor and Printing, but the report of the mining industry of the State during 1900 will be published as one of the series of *economic papers* of the Survey. The results of the investigation by Dr. Pratt into the talc deposits of the State have been published as *Economic Paper No. 3.*

### FOREST INVESTIGATIONS.

2. In the forestry investigations, under Mr. W. W. Ashe, the work has been continued mainly in the eastern counties with the view of determining the rate of growth of the short-leaf pine under different physical conditions, this being a part of the general purpose of our forestry examination, which is to determine what forest growth of commercial value is best adapted to the different conditions of soil, moisture, etc., as they exist in different regions. The short-leaf, or loblolly pine, in the eastern counties, is to-day undoubtedly our most valuable commercial tree. The investigation as to this tree and as to how forests of it may be propagated to the best advantage was begun in the summer of 1891, the Forestry Division of the United States

Department of Agriculture, co-operating with the Geological Survey in this examination during the spring and summer of the present year. Mr. Ashe was assisted by Mr. J. A. Caldwell, Jr., of Salisbury, and Mr. H. M. Curran of the Agricultural and Mechanical College, Raleigh, and for a short time these were further assisted by two graduate students from the Agricultural and Mechanical College. They have traversed each of our eastern counties, investigating the density and rate of growth of the pine on different soils, as far as possible, and of the amount of standing timber of different sizes on these pine lands. The results of these examinations are now being tabulated, and the report on the same will be prepared by Mr. Ashe during the winter and spring months. At the present time the Survey is co-operating with the State Board of Agriculture in examining the lowlands bordering the Roanoke and other eastern streams, with a view of determining whether it will pay better to reclaim these lands for agricultural purposes or to use them for the growth of commercially valuable forest trees; and Mr. Ashe is now on the Roanoke river engaged in examining these lands bordering that stream.

### WATER-POWER INVESTIGATIONS.

In connection with the water-power investigation (of which Mr. E. W. Myers is in charge), the work undertaken in the fall of 1895 and in the spring of 1896 by the North Carolina Geological Survey and of the United States Geological Survey, working in co-operation, has been vigorously prosecuted during the past two years along the original lines laid out for it. Stations have been established and maintained on the following rivers: On the Roanoke river near Neals; on the Dan and Stanton rivers just above the junction to form the Roanoke; on the Tar river at Tarboro; on the Neuse river near Selma; on the Cape Fear river at Fayetteville; on the Deep river near Moncure; on the Yadkin river near Salisbury; on the Pee Dee river near Norwood; on the Catawba river at Catawba; on the Broad river near Gaffney, S. C.; on the French Broad river at Asheville; on the Tuckaseegee river at Bryson City; on the Little Tennessee river at Judson, and on the Hiawassee river at Murphy, thus covering all the principal water-power streams of the State. No effort has been made to establish these stations on the tributary streams, since the

data gathered from the main streams are applicable to the tributaries as well.

At all these stations a man has been employed to take daily readings of the stage of the water-surfare on a permanent gauge established by the Survey, and to make a record of the same in a book furnished for the purpose. Weekly reports are made to the office of the Survey of this and all other data which may be obtained during the week relative to the flow of the stream and the causes affecting it. At all these stations instrumental gaugings of the volume of flow have been made from time to time, these varying in number from four to nine for each station during the current year. Eighty-six measurements were thus made during the year 1899. From these measurements the station-rating tables are constructed, giving the volume of flow for every gauge-height that the river has reached during the year. From these tables and the record of the daily gauge-pipe, when extended over a sufficiently long period, the value of the river as a source of water-power can be accurately determined.

Although these measurements were undertaken such a short time ago, already their value is very great and increases greatly with every year over which they are extended. Accurate data of the flow of any Southern stream was not available previous to the inception of this work, and such information was very badly needed on account of the beginning made some few years ago of the development of some small part of the vast undeveloped water-power of the South. From the beginning the development of the water-power is every year growing at an increasingly rapid rate, and thus every year the information derived from these measurements is more eagerly sought for. Much information concerning water-powers and the rate and volume of the flow of the various streams has been furnished during the year to investors and those contemplating the development of water-power in the near future.

It has been planned to extend the scope of the work so as to make it include data of more thoroughly scientific value than any heretofore obtained, which have been of more decided economic value. Thus it is proposed to obtain the surface slope of the stream at several stations, and in this way discover more accurately the relation existing between this factor, the character of bed and bank, and the volume of the flow.

The stream investigations in the western portion of the State were carried on with special energy during the past several months owing to the bearing that these investigations would have on the establishment of the proposed National Forest Reserve in Western North Carolina and adjacent States.

Arrangements have also been made with the U. S. Weather Bureau whereby additional rain-fall and temperature stations will be established within the drainage basins of several streams in this State, thus making it possible to more accurately investigate the relation between the amount and distribution of the rain-fall and the annual run-off of the streams.

Experiments have already been undertaken to determine the relative run-off from areas of widely different geologic structure, and these will be further prosecuted during the year.

Mr. Myers has been assisted in this work by Messrs. H. A. Pressey, Cleveland Abbe, Jr., L. V. Branch, N. C. Curtis and Ernest Graves.

The larger part of the information concerning the flow of the streams which was gathered prior to January 1, 1899, has been published in Bulletin No. 8 of the Survey series.

In connection with both the forestry and water-power investigations, it may be of interest to mention the work which is now being done under two of the government scientific bureaus, co-operating with the State Geological Survey in the mountain counties of Western North Carolina and adjacent States, with a view of selecting a location for the proposed Appalachian Forest Reserve in this region. Two parties of three men each have already begun the investigation of the amount of water flowing through and out of this mountain region, with the view of demonstrating to the country the importance of protecting more or less of forest growth about the head-waters of a large number of our important rivers which have their sources in this region, and during the summer and autumn months there will be carried on under the supervision of the Secretary of Agriculture a careful examination of the forest resources of this region.

## MINERAL AND ARTESIAN WATERS.

In connection with the examination of the more important mineral waters of the State, samples of these have been collected by special agents of the Survey, who at the same time gathered data as to the volume of flow and temperature of the water at each of the springs and wells. These analyses have been made by Prof. F. P. Venable, and his report covering this subject is now ready for publication.

In the way of additional chemical work the analyses of a number of ores and miscellaneous minerals have been made by Dr. Charles Baskerville.

The investigation of the artesian water supplies in the eastern counties has been continued by the State Geologist, who has examined during the year a considerable number of these wells, and he has also made a special study of geological formations along the Cape Fear river, with a view of possible water-supplies from them. He has now in preparation a report embodying all the available data concerning the deep-well supplies of water in the eastern counties. Perhaps the most notable of the deep wells now being sunk is that which is being drilled by the Federal Government at Fort Caswell at the mouth of the Cape Fear river.

## GOOD-ROADS MOVEMENT.

The Geological Survey has continued to take an active interest in the question of public road improvement. At intervals during the year the State Geologist has visited almost every county in the State where this work has been in progress, and has rendered such service as he could in the way of examining materials best suited for the road-building, and giving information and advice to those in charge of the same. He gave a public address before the last General Assembly on this subject, and has since given a number of similar lectures in different portions of the State. During the second week in last July he held a Road-builders' Institute in Charlotte, which was attended by nearly all the supervisors of roads in counties where efforts are being made in the direction of highway improvement, and also by a number of road supervisors from South Carolina. He has also prepared and will publish during the winter a report of road materials and road-building in North Carolina.

## CO-OPERATION OF GOVERNMENT BUREAUS.

Several of the government scientific bureaus have co-operated with the State during the past year with considerable liberality. First among these should be mentioned the U. S. Geological Survey, which has had during a larger part of the season two full topographic parties in this State, and these have surveyed and are now surveying maps for the 1,198 square miles territory lying mainly in Buncombe, Yancey, Burke and McDowell counties. This will be published in the Mount Mitchell atlas sheet. The careful and accurate manner in which this work has been done leaves little to be desired except in the way of pushing the surveys forward more rapidly. Some work has been done towards the revision of the Morganton atlas sheet. About one-fourth of the total area of the State has now been surveyed and mapped. In geological work, Mr. Arthur Keith, one of the geologists of that survey, has been continuously engaged for several years in examining and mapping the rock formations of the western counties.

## MERIDIAN SURVEYS AND MONUMENTS.

The Coast and Geodetic Survey has also co-operated with us in the establishment of magnetic meridian monuments at the various county-seats and in the making of a general magnetic survey. This work has been generally a triple system of co-operation. The Government Survey has paid the salary and generally the *per diem* expenses of the expert in charge of this work, Mr. J. B. Baylor. The several counties have paid certain incidental expenses, such as the cost of the meridian monuments and the immediate work of setting them in place, this cost, as a rule, being less than fifteen dollars per county. The State Geological Survey has paid other expenses of the work, and during a portion of the year has also paid the *per diem* living expenses of the engineer, and the full incidental expenses connected with the setting up of the monuments in cases where the counties failed to do this. These monuments have been erected at all the county-seats, at the State University and the Agricultural and Mechanical College, the work having been completed in November, 1900. North Carolina now has within her borders a larger number of meridian stations than any other State. The general magnetic conditions

have been examined at every county-seat in the State and at a few other points of interest. The true north and south lines have been determined at each of these county-seats and have been marked at each by two granite posts set 300 to 600 feet apart. So that at or near every county-seat in the State surveyors and engineers can now test the accuracy of their compasses with ease and certainty. Maps have been constructed and will soon be published showing the declination (or variation) of the compass, and a State survey report will describe in detail the general magnetic condition of the State and will give specific directions to engineers and surveyors as to how to use the meridian monuments and maps to the best advantage. Furthermore, at the county-seats a standard measure has been determined which will enable the surveyors to test the accuracy of their measuring chains. The magnetic observations upon which this report is based have been made in a highly creditable manner by Mr. J. B. Baylor of the U. S. Coast and Geodetic Survey.

### SOIL INVESTIGATIONS.

The soil investigations which were inaugurated during the spring season by the U. S. Department of Agriculture and the Geological Survey co-operating were carried on during the summer and autumn seasons, the work being limited largely to a belt 10 miles wide, along the railway line from Raleigh to New Bern, for the reason that this was the only area of which sufficiently accurate maps could be easily prepared. During the late autumn season, however, work was begun by the U. S. Geological Survey with a view of mapping at an early date a considerable number of counties lying in central Eastern North Carolina. During the next year it is proposed to continue the examination of the soils on a large scale. The object of this work is to determine the character and distribution of the different varieties of soil in Eastern North Carolina, and to determine further the character of the crops and forest growth best adapted to each of these varieties.

### FISHERY AND OYSTER INVESTIGATIONS.

The United States Fish Commission has also co-operated with the Survey in a most liberal way, as follows:

1. In the establishment of a fish hatchery at Edenton, where a lot

has been purchased, buildings erected and a regular hatchery station established, at a cost of $21,000; and from this a large number of young shad and other fish will turned loose in the North Carolina waters each year.

2. In the establishment of a biological laboratory at Beaufort, at a cost of $31,000, which has for its object the investigation of marine fishes, oysters, clams and other forms which are connected directly or indirectly with the fishery interests of our sea coast region. During the present year this laboratory was opened only during the summer months, but in the future it is hoped that it can be kept open throughout the entire year. Prof. H. V. Wilson, the Biologist of the Geological Survey, served as Director of this laboratory without pay.

3. In connection with oyster investigations in our eastern waters, the United States Fish Commission, at the request of the Geological Survey, sent to Beaufort in October, 1899, the United States steamer Fish Hawk, with a crew of forty men, including several oyster experts, for the purpose of making a thorough examination of the North Carolina oyster beds, with especial reference to the possibility of successful oyster planting in these waters. Dr. Caswell Grave of Johns Hopkins University was appointed Assistant Biologist of the Survey and employed as additional expert on board the Fish Hawk in the months of October and November at a salary of $125 per month and expenses, of which amount $100 and expenses was paid by the United States Fish Commission. Early in January the Fish Hawk was transferred to Pamlico Sound, where, during that and the three following months, her officers and men, together with several special experts, continued the oyster investigation in different portions of that region. The reports embodying the results of these investigations have already been submitted to the United States Commissioner of Fish and Fisheries, and at an early date will be published both by the United States Fish Commission and the Geological Survey. Towards the end of April the Fish Hawk was transferred to Chesapeake Bay, where it was arranged that she should co-operate in the hatching out of young shad. Dr. Caswell Grave, who, from the first of October to this time had been the biological expert in these investigations on board the Fish Hawk, was transferred to Beaufort, N. C., where, during May and early June, he has inaugurated an experimental oyster farm, and in co-operation with the United States Fish Com-